of the layers, and higher circumferential strain. Also, a larger variation in circumferential strain occurs with increasing tension, which would result in a greater variation in the EFL.

The effect of a variable tension was investigated by changing the initial stress for each of the layers. Simulations were performed with the tension starting at 30.0 N, and linearly decaying to values of 25.0, 20.0, 15.0 and 10.0 N, respectively. The range of tension values was broken into fifty increments, and the corresponding initial stresses were assigned to the appropriate layers. Plots of the radial and circumferential stress and strain are shown in Figure 23. The 30.0 N constant tension case is also shown in the graph for comparison. The plot shows that the decay in tension has only a slight influence on the radial stress and strain, but has a very strong effect on the distribution of circumferential stress and strain. The appropriate choice of tension decay will flatten out the right portion of the circumferential strain curve, but a large variation will still exist between the left and right sides of the curve. If the starting tension was increased or decreased, the variation would still be present, but it may change in magnitude.

In the present invention, the addition of a compliant layer (such as a soft pad) to the surface of the reel could influence the strain distribution in the wound material. In order to simulate a compliant layer on the reel, different material properties were assigned to the first layer in the model. The modulus for the regular material was taken to be 1.637 GPa, and Poisson's ratio was 0.1. Several cases were run with the modulus of the first layer reduced by 10.0, 50.0, and 100.0 times that of the regular material. The Poisson's ratio was 0.1 for the first layer in each case. Additional cases were run using the same set of reduced modulus values for both the first and second layers. The tension was kept constant at 30.0 N for each case. Plots of the radial and circumferential stress and strain are shown in Figure 24. The

curve labeled as baseline in the graphs is the case without a compliant layer. The stress and strain for the compliant layers are not shown in the graphs because they experience large deformation. Also, the stress levels in the compliant layer are of no interest since the rest of the layers would be representing the wound buffer tube material. The data indicates that the compliant layer helps to reduce the radial compression within the layers, with the most severe cases changing the concavity of the radial stress and strain curves. The reduction in radial compression causes a drop in the circumferential strain within the layers closest to the reel surface. A large reduction in the modulus of the compliant layer causes the circumferential strain to change from a state of tension to a state of compression in the layers near the surface of the reel. The concavity of the circumferential strain curve also changes as the modulus of the compliant layer is reduced.

The concentric layer model was used to study the effect of compliant layers distributed among the regular material layers on the stress and strain distribution. A simulation was performed using a material with a reduced modulus in place of the regular material for layers number ten, twenty, thirty and forty. An additional simulation was performed for compliant material in place of layers ten, eleven, twenty, twenty one, thirty, thirty one, forty, and forty one. The modulus of the compliant material was reduced by a factor of thirty from the regular material to a value of 0.5456 GPa, and Poisson's ratio was taken to be 0.1. Plots of the radial and circumferential stress and strain are shown in Figure 25A. The baseline case without compliant layers is also shown in the plots. The stress and strain values within the compliant layers are not included in the curves because the main focus is the resulting distribution within the regular material. The curves show that the compliant layers cause a significant amount of variation in the circumferential stress and

strain when compared to the baseline case. This would lead to a greater variation in the EFL distribution than the baseline case.

As an alternative to the distributed compliant layers, a case was considered with distributed stiff layers. Simulations were performed with stiff layers in the same configuration as the compliant layers discussed previously. The modulus of the stiff layers was increased ten times that of the regular material, to a value of 16.37 GPa, and Poisson's ratio was taken to be 0.1. An additional case was considered with a modulus one hundred times greater than the regular material, or 163.7 GPa. Plots of the radial and circumferential stress and strain are shown in Figure 25B. The curves show that the stiff layers act to reduce the variation in circumferential stress and strain, and therefore would reduce the variation in EFL.

Another case that was considered to control the distribution in EFL was an expandable core. This case was modeled by removing the constraints on the boundary of the inner layer, and applying a normal pressure to the surface. The boundary was released, and the pressure was applied after all layers were added. Simulations were performed with pressures of 10.0, 20.0, and 40.0 MPa, respectively. Plots of the radial and circumferential stress and strain are shown in Figure 25C. The curves show that the pressure shifts the circumferential stress and strain curves up, and also changes the shape of the curves. The effect of the pressure is more pronounced within the layers closest to the reel surface. The increase in strain in the layers resulting from the pressure would cause a decrease in EFL. This effect would need to be combined with another method of EFL control in order to obtain a desirable EFL distribution. If this technique were to be used, it would need to be determined if the pressure would damage the layers of buffer tube near the reel surface. The